

## CLAIMS

I claim:

- 1 1. A magnetic head comprising:  
2 a free magnetic layer;  
3 a bias layer having a width and being disposed parallel to the free magnetic layer  
4 and configured to induce a bias magnetic field in the free magnetic layer; and  
5 a bias pinning layer disposed parallel to the bias layer, having a width that is  
6 greater than the bias layer width, and configured to induce a stabilization magnetic field  
7 in the bias layer.
- 1 2. A magnetic head according to claim 1, wherein the width of the bias pinning layer  
2 is at least three times the width of the bias layer.
- 1 3. A magnetic head according to claim 1, wherein the bias pinning layer includes  
2 cobalt samarium (CoSm) or cobalt platinum chromium (CoPtCr).
- 1 4. A magnetic head according to claim 1, wherein the bias pinning layer includes  
2 cobalt samarium having between 60 at.% and 95 at.% cobalt and between 40 at.% and 5  
3 at.% samarium.
- 1 5. A magnetic head according to claim 1, wherein the bias pinning layer includes

2 cobalt platinum chromium having between approximately 80 at.% and 68 at.% cobalt,  
3 approximately 12 at.% platinum, and between approximately 8 at.% and 20 at.%  
4 chromium.

1 6. A magnetic head according to claim 1, wherein the bias pinning layer has a  
2 thickness that is between approximately 10 angstroms (Å) and approximately 50 Å.

1 7. A magnetic head according to claim 1, wherein:  
2 the bias pinning layer includes a bias pinning material and has a bias pinning  
3 thickness; and  
4 the bias pinning material and the bias pinning thickness are selected such that the  
5 bias pinning layer has high coercivity and high resistivity.

1 8. A magnetic head according to claim 1, further including a pinned magnetic layer  
2 structure having a width that is substantially greater than a width of the free magnetic  
3 layer.

1 9. A magnetic head according to claim 1, further including:  
2 an anti-ferromagnetic layer having a width that is substantially greater than a  
3 width of the free layer; and  
4 a pinned magnetic layer structure having a width that is substantially greater than  
5 the width of the free magnetic layer.

1 10. A magnetic head according to claim 9 wherein the width of the pinned magnetic  
2 layer structure is at least three times the width of the free magnetic layer.

1 11. A magnetic head according to claim 1, further including a pinned magnetic layer  
2 structure including a first pinned magnetic layer, an antiparallel coupling layer and a  
3 second pinned magnetic layer, wherein said second pinned magnetic layer has a width  
4 that is approximately equal to a width of the free magnetic layer and the first pinned  
5 magnetic layer has a width that is at least three times the width of the second pinned  
6 magnetic layer.

1 12. A hard disk drive for reading and writing information in a magnetic medium, the  
2 disk drive comprising:

3 a disk having a surface that includes the magnetic medium;

4 a motor coupled to rotate the disk;

5 a slider having an air bearing surface;

6 an actuator configured to hold the air bearing surface of the slider proximate to  
7 the surface of the disk;

8 a magnetic head disposed within the slider and forming part of the air bearing  
9 surface, wherein the magnetic head includes:

10 i) a free magnetic layer;

11 ii) a bias layer having a width and being disposed parallel to the free  
12 magnetic layer and configured to induce a bias magnetic field in the free magnetic

13 layer; and

14 iii) a bias pinning layer disposed parallel to the free magnetic layer and the  
15 bias layer, having a width that is greater than the bias layer width, and configured  
16 to induce a stabilization magnetic field in the bias layer.

1 13. A hard disk drive according to claim 12, wherein the width of the bias pinning  
2 layer is at least three times the width of the bias layer.

1 14. A hard disk drive according to claim 12, wherein the bias pinning layer includes  
2 cobalt samarium (CoSm) or cobalt platinum chromium (CoPtCr).

1 15. A hard disk drive according to claim 12, wherein the bias pinning layer includes  
2 cobalt samarium having between 60 at.% and 95 at.% cobalt and between 40 at.% and 5  
3 at.% samarium.

1 16. A hard disk drive according to claim 12, wherein the bias pinning layer includes  
2 cobalt platinum chromium having between approximately 80 at.% and 68 at.% cobalt,  
3 approximately 12 at.% platinum, and between approximately 8 at.% and 20 at.%  
4 chromium.

1 17. A hard disk drive according to claim 12, wherein the bias pinning layer has a  
2 thickness that is between approximately 10 angstroms (Å) and approximately 50 Å.

1 18. A hard disk drive according to claim 12, wherein:  
2 the bias pinning layer includes a bias pinning material and has a bias pinning  
3 thickness; and  
4 the bias pinning material and the bias pinning thickness are selected such that the  
5 bias pinning layer has high coercivity and high resistivity.

1 19. A hard disk drive according to claim 12, further including a pinned magnetic layer  
2 structure having a width that is substantially greater than a width of the free magnetic  
3 layer.

1 20. A hard disk drive according to claim 12, further including:  
2 an anti-ferromagnetic layer having a width that is substantially greater than a  
3 width of the free layer; and  
4 a pinned magnetic layer structure having a width that is substantially greater than  
5 the width of the free magnetic layer.

1 21. A hard disk drive according to claim 20 wherein the width of the pinned magnetic  
2 layer structure is at least three times the width of the free magnetic layer.

1 22. A hard disk drive according to claim 12, further including a pinned magnetic layer  
2 structure including a first pinned magnetic layer, an antiparallel coupling layer and a  
3 second pinned magnetic layer, wherein said second pinned magnetic layer has a width

4 that is approximately equal to a width of the free magnetic layer and the first pinned  
5 magnetic layer has a width that is at least three times the width of the second pinned  
6 magnetic layer.

1 23. A method for fabricating a magnetic head, comprising:

2 depositing a plurality of sensor layers, including:

3 i) a pinned magnetic layer;

4 ii) a spacer layer;

5 iii) a free magnetic layer;

6 iv) a bias spacer layer; and

7 v) a bias layer;

8 removing outer portions of a plurality of layers, including the spacer layer, the  
9 free magnetic layer, the bias spacer layer, and the bias layer;

10 depositing an electrical lead layer upon outer portions of the pinned magnetic  
11 layer; and

12 depositing a bias pinning layer upon the bias layer.

1 23. The method of claim 22, the removing of outer portions of the layers further  
2 includes removing outer portions of the bias pinning layer.

1 24. The method of claim 22, the removing of outer portions of the layers further  
2 includes removing outer portions of the pinned magnetic layer.

1     25.     The method of claim 22, wherein:  
2             the pinned magnetic layer includes a first pinned magnetic layer, an anti-parallel  
3     coupling layer, and a second pinned magnetic layer;  
4             the removing of outer portions of the layers further includes removing outer  
5     portions of the first pinned magnetic layer, the anti-parallel coupling layer, and the  
6     second pinned magnetic layer.